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Growth performance evaluation of genetically improved silver barb (*Barbonymus gonionotus* Bleeker) in different agro-ecological zones in Bangladesh

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Abstract
On farm trials of silver barb with other carps were carried out in 40 ponds during May to October 2005 in four agro-ecological zones viz., Trishal, Muktagacha, Parbotipur and Paikgacha in Bangladesh. In Trishal and Muktagacha zones, ponds were stocked with silver barb, silver carp and common carp at the stocking density of 11,500 fish/ha, whereas in Parbotipur and Paikgacha zones, ponds were stocked with silver barb, rohu, catla and mrigal at the stocking density of 10,000/ha. Among the ponds, 50% (20 ponds) were stocked with BFRI improved stock of silver barb (Treatment-1) and rest of the 20 ponds stocked with local silver barb stock (Treatment-2). The harvest weight of BFRI improved silver barb were 149±16.01, 168±18.06, 198±14 and 230±9.25g in Trishal, Muktagacha, Paikgacha and Parbotipur, whereas the data obtained at 113±15.52, 136±20.66, 170±17.0 and 205±12.10g for local stock of silver barb, respectively. In all trials, the harvest weight of BFRI improved stock showed significantly higher growth performance ($P<0.05$) over the local stocks.

Key words: Genetically improved silver barb, agro-ecological zones

Introduction

Silver barb (*B. gonionotus*) is a popular species among fish farmers of Bangladesh because it grows faster and well on low protein diets, whether feeding on certain aquatic plants or given supplementary feeds and can tolerate a wide range of environmental conditions. In Bangladesh, breeding is mainly carried out by hypophysation. For aquaculture, the farmers mainly depend on hatcheries for fingerlings of silver barb. There is a possibility of inbreeding in most of the small hatcheries where female and male are chosen from closed populations of very limited size (Hussain and Islam 1999). Genetic deterioration of existing stocks of silver barb has been reported (Hussain and Mazid 2001). Genetic stock improvement through genetic selection is one of the most useful ways of enhancing desirable traits in a founder stock with high genetic variability to reduce inbreeding in a hatchery population (Eknath *et al.* 1998).

The genetic stock improvement program of silver barb was initiated in 1996 at Bangladesh Fisheries Research Institute (BFRI) under the technical assistance of WorldFish Center (formerly ICLARM). It was initiated with three different stocks of fish from Indonesia, Thailand and Bangladesh and the follow up mass selection protocol was continued up to the seventh generation. The 7th generation of silver barb showed 32% higher growth in comparison to the base population of silver barb. The present paper deals with the results of the improved silver barb under different farming conditions in Bangladesh.

Materials and methods

Origin of improved silver barb and local silver barb

The improved fingerlings used in this experiment were developed from 7th generation of silver barb descended from mass selection experiment. The local silver barbs were produced in local hatchery in different locations of the country.

Study area

On farm trials of silver barb with other carps were carried out from 15 May to 15 October 2005 in four different agro-ecological zones at Trishal and Muktagacha in Mymensingh zone, Paikgacha in Khulna zone and Parbatipur in Dinajpur zone of Bangladesh. Each zone had 10 ponds with a range of area of 600 -1000 m^2 and a depth of 1.0-1.5m.

Experimental design and fish stocking

In Trishal and Muktagacha of Mymensingh zone, there were two treatments with five replications. Both the treatments were designed with silver barb (*B. gonionotus*), silver carp (*H. molitrix*) and common carp (*C. carpio*) at the stocking density of 7,500, 2,000 and 2,000/ha. In treatment-1, ponds were stocked with BFRI improved silver barb stock and in treatment-2 with locally available existing stock of silver barb. For the ponds in Paikgacha and Parbatipur, there were also two treatments with five replications. Both the treatments were designed with silver barb (*B. gonionotus*), rohu (*L. rohita*), catla (*C. catla*) and mrigal (*C. mrigala*) at the respective stocking density of 2500, 2500, 2500 and 2500 fish/ha. BFRI Improved stock of silver barb and locally available existing stock was stocked in treatment-1 and treatment-2, respectively.

Fish rearing and pond management

Stocked fingerlings were fed with commonly available agricultural by-products, rice bran (70%) and mustard oil cake (30%) at the rate of 3-4% of standing biomass of fish regularly. All the ponds were fertilized with organic fertilizer (cow dung) at the rate of 2,000 kg/ha/month.

Harvesting of fish and data analysis

After five months of rearing, all fish were harvested through seine netting and pond drying. During harvesting, fishes were counted and weighed from each pond to assess the survival rate and production. The growth and production data were analysed using a one-way analysis of variance (ANOVA). Results were tested to identify significant differences ($P<0.05$) between the means.

Results and discussions

Details of growth parameters and production of fish in different agro-ecological zones such as Trishal, Muktagacha, Paikgacha and Parbatipur are presented in Tables 1, 2, 3 and 4, respectively. In Trishal zone, at harvest the weight of improved silver barb (BFRI stock) was statistically significant and higher than that of local silver barb (149±16.01 vs. 113±15.52g in treatments-1 and 2, respectively). The weight of silver carp and common carp in treatments-1 and 2 were almost similar ($P> 0.05$). However, the total production of treatments-1 and 2 were significantly different (2,556 vs. 2,070 kg/ha/6 months, respectively).

Table 1. Harvesting weight and production performances of BFRI improved stock and local stock of silver barb along with other species in Trishal zone

Treatment	Species	Harvesting weight (g)	Survival (%)	Production (Kg/ha)	
				Species-wise production	Total production/ha
T-1	Silver barb (BFRI stock)	149±16.01*	92	1,035±66.6	2,556±108.33*
	Silver carp	523±49.46	84	888±97.16	
	Common carp	421±42.15	75	632±77.39	
T-2	Silver barb (Local stock)	113±15.52	88	755±125	2,070±177
	Silver carp	510±70.08	82	844±140	
	Common carp	383±93.39	61	471±53.04	

* Significant at 0.05% level

In Muktagacha zone, significant difference in harvest weight between the improved and local silver barb was also observed (Table 2). Although there were no significant difference in harvest weights of silver carp and common carp between the treatments. The total yield obtained in ponds stocked with BFRI improved silver barb was significantly higher than in ponds stocked with local silver barb strain (2,198 vs.1,790 kg).

Table 2. Growth and production performances of BFRI improved stock and local stock of silver barb along with other species in Muktagacha zone

Treatment	Species	Harvesting weight (g)	Survival (%)	Production (Kg/ha)	
				Species-wise production	Total production/ha
T-1	Silver barb (BFRI stock)	168±18.06*	93	1178	2,198±186*
	Silver carp	367±40.17	82	601	
	Common carp	282±41.11	74	418	
T-2	Silver barb (Local stock)	136±20.66	84	858	1,790±142
	Silver carp	322.55±34.81	88	516	
	Common carp	297.20±32.88	69	415	

* Significant at 0.05% level

In Paikgacha zone, polyculture of BFRI improved silver barb stock with Indian major carps (treatment 1) also obtained higher body weight at harvest than that of local silver barb stock in treatment-2 and they were significantly different ($P<0.05$)(Table 3). The final weight of catla, rohu and mrigal were not significantly different between the treatments. Total fish production after five months of culture was 2,353±102 and 2,305±114 kg/ha in treatments-1 and 2, respectively and slightly higher production in treatment-1 was obtained due to the presence of BFRI improved stock in it.

Table 3. Growth and production performances of BFRI improved stock and local stock of silver barb stock along with other species in Paikgacha zone

Treatment	Species	Harvesting weight (g)	Survival (%)	Production (Kg/ha)	
				Species-wise production	Total production/ha
T-1	Silver barb (BFRI stock)	198±14*	93	465±52	2,353±102
	Catla	370±28	81	758±64	
	Rohu	240±20	87	522±42	
	Mrigal	310±15	78	612±39	
T-2	Silver barb (Local stock)	170±17	83	353±40	2,305±114
	Catla	350±30	88	770±56	
	Rohu	246±24	85	523±35	
	Mrigal	326±12	80	660±24	

* Significant at 0.05% level

Silver barb reached to an average harvest weight of 230±9.25 and 205±12g in treatments-1 and 2, respectively in Parbatipur zone (Table 4). There were no significant differences in harvest weights of catla, rohu and mrigal between the treatments ($P>0.05$). Total production of fish in treatment-1 was 2,597±129g where BFRI stock of

silver barb was stocked, whereas in treatment-2 where local silver barb was stocked, it was 2,515±99g. The total production did not show any significant difference (P>0.05) showed between the treatments.

Table 4. Growth and production performances of BFRI improved stock and local stock of silver barb stock at Parbatipur zone

Treatment	Species	Harvesting weight (g)	Survival (%)	Production (Kg/ha)	
				Species-wise production	Total production/ha
T-1	Silver barb (BFRI stock)	230±9.25*	90	518±32	2,410±129^{NS}
	Catla	390±16.11	77	758±41	
	Rohu	260±22.20	80	522±28	
	Mrigal	340±11.25	72	612±44	
T-2	Silver barb (Local stock)	205±1210.29	80	430±28	2,296±99
	Catla	372±25.11	74	688±34	
	Rohu	275±17.28	81	563±48	
	Mrigal	328±23.29	75	615±36	

* Significant at 0.05% level

In all the regions, the survival rate of silver barb of BFRI stock showed higher survival than local stock. The survival rate of silver barb of BFRI stock in Trishal, Muktagacha, Paikgacha and Parbatipur were 92.38, 93.21, 93.92 and 90.16%, respectively. Whereas the survival rate were 88.92, 84.00, 83.04 and 80.84% incase of local stock of silver barb at Trishal, Muktagacha, Paikgacha and Parbatipur in respectively. From the results, it is clear that Local existing stock showed less survival rate over BFRI stock because the brood stock are being used by the hatchery operators might be of genetically deteriorated or inbred.

To compare the performance of present study, several previous studies could be illustrated. Kohinoor *et al.* (1995) reported a production of 1,718 kg/ha/6 months from the monoculture of rajpunti (*B. gonionotus*) with the stocking density of 15,000/ha. Kohinoor *et al.* (1999) conducted an experiment of silver barb (*B. gonionotus*) with silver carp (*H. molitrix*) and common carp (*C. carpio*) in on station management practice and obtained an average production of 2,056 kg/ha in six months period. In another study, Wahab *et al.* (2001) observed that polyculture of rohu, catla and common carp with rajpunti (*B. gonionotus*) yielded a gross production of 1,902 kg/ha/4 months culture period. The productions of present study were much higher than the above mentioned studies.

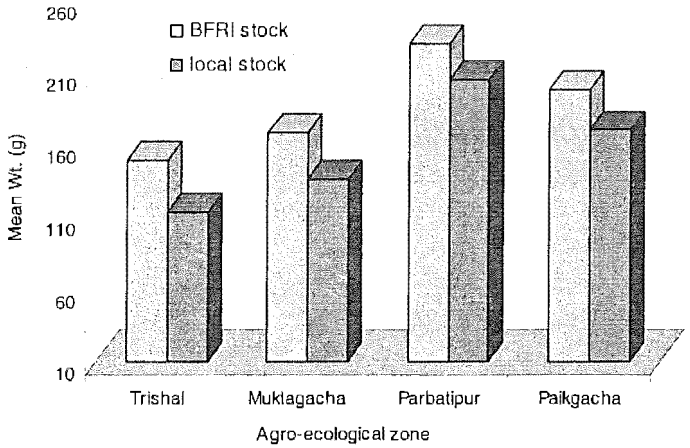

Fig. 2. Mean Wt. (g) of silver barb of BFRI stock and local stock in different locations

It is evident that silver barb of BFRI improved stock had a higher growth and production over the existing local silver barb stock in all the treatments (Fig. 1). Local existing stock of silver barb showed less weight gain. The BFRI improved stock, on the other hand, showed higher growth performance due to its greater genetic gain, which developed over several generations of selection.

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